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INSECTS

Chemical Classes and Their Modes of Activity

Entomologists emphasize that you should be sure to rotate insecticides. Rotating insecticides/miticides helps to ensure their longevity and effectiveness, and they minimize the potential for the development of resistant pest populations. It is important to understand how insecticides/miticides work on insect and mite pests that attack landscape and nursery plants so the appropriate materials can be used.

Insecticides/miticides are separated into different chemical classes based on their mode of activity. The chemical classes of materials used in the landscape and nursery include chlorinated hydrocarbons (organochlorines), organophosphates, carbamates, pyrethroids, macrocyclic lactone, chloronicotinyls, insect growth regulators, and soaps and oils. Common insecticides/miticides used in landscapes and nurseries and their chemical classes are presented in Table 1. Chemical classes and their modes of activity are categorized in the following six groups:

1. Organophosphates and carbamates work by inhibiting the enzyme cholinesterase, which prevents the termination of nerve impulse transmission.
2. Chlorinated hydrocarbons and pyrethroids work by destabilizing nerve cell membranes.
3. Macrocyclic lactone affects gamma-amino butyric acid (GABA)–dependent chloride ion channels, which inhibits nerve transmission.
4. Chloronicotinyls work on the central nervous system, causing overstimulation and blockage of the postsynaptic nicotine acetylcholine receptors.
5. Insect growth regulators are chitin synthesis inhibitors or juvenile hormone mimics. Chitin synthesis inhibitors prevent the formation of chitin, an essential compound of an insect's exoskeleton. Juvenile hormone mimics cause insects to remain in a young life stage.
6. Soaps and oils work by damaging the waxy layer of the exoskeleton of soft-bodied insects, resulting in desiccation (drying), or by covering the breathing pores (spiracles) of insects, resulting in suffocation.

Several chemical classes have very similar modes of activity. The organophosphates and carbamates, despite being different chemical classes, both have similar modes of activity (they are acetylcholinesterase inhibitors). So using acephate (Orthene), then switching to bendiocarb (Dycarb, Turcam), is not a proper rotation scheme. Similarly, chlorinated hydrocarbons and pyrethroids have identical modes of activity (they affect nerve cell transmission). In this case, using dicofol (Kelthane), then switching to bifenthrin (Talstar), would not be a proper rotation scheme. Examples of rotating different chemical classes include:

Dursban->Talstar->insecticidal soap->Diazinon (Group: 1->2->6->1)
Orthene->Tame->Avid->Mesurol (Group: 1->2->3->1)
Avid->horticultural oil->Kelthane->insecticidal soap (Group: 3->6->2->6)
Dursban->Napalm*

*This is a total eradication rotation.

Rotating different chemical classes with varied modes of activity helps extend the longevity of currently available insecticides and leads to less chance that insect and mite populations will develop resistance. *(Raymond Cloyd)*

Table 1. Chemical classes of insecticides and miticides used in landscapes and nurseries. (Numbers in parentheses indicate group number.)

Organophosphates (1)
acephate (Orthene, Pinpoint)
chlorpyrifos (Dursban)
malathion (Cythion)
diazinon (Diazinon)
dimethoate (Cygon)

Carbamates (1):
bendiocarb (Turcam, Dycarb)
carbaryl (Sevin)

Pyrethroids (2):
bifenthrin (Talstar)
cyfluthrin (Tempo, Decathlon)
lambda-cyhalothrin (Scimitar, Topcide)
permethrin (Astro)

Chlorinated hydrocarbons (2):
dicofol (Kelthane)
endosulfan (Thiodan)
lindane (Lindane)

Macrocyclic lactone (3):
abamectin (Avid)

Chloronicotinyls (4):
imidacloprid (Marathon, Merit)

Insect growth regulators (5):
azadirachtin (Azatin)

Soaps and oils (6):
potassium salts of fatty acids (insecticidal soap)
paraffinic oil (Sunspray ultrafine spray oil)

Sod Webworms

During dry periods, keep an eye out for sod webworm attack in turf. Sod webworm larvae are normally controlled naturally by microsporidia in Illinois. These microbes are most effective under moist conditions. With our rather consistent rainfall in Illinois, sod webworms are not a problem that we expect every year. However, during dry spells when unwatered grass goes brownish and dormant, sod webworms can become numerous without the damage being noticed. This happened in McHenry, Lake, and parts of Kane counties in northeastern Illinois in late July.

Larvae are slender and greenish to grayish in color with brown spots. They emerge at night to clip the grass blades close against the crown, causing brownish areas of turf because the thatch shows through. Close observation reveals that there are not as many grass blades present as there should be. And, if you look closely, you can usually see numerous pinhead-sized, green balls of feces left by the larvae. During the day, larvae are in their silk-lined tunnels in the thatch.

You can flush the caterpillars out of their tunnels by applying an irritant disclosing solution. This solution can be a teaspoon of 5 percent pyrethrin or 2 tablespoons of dishwashing detergent per gallon of water. Use a watering can or another method to distribute this mixture evenly over a square foot of turf. Within 30 seconds or so, sod webworms, black cutworms, ground beetles, rove beetles, earthworms near the surface, and various other creatures will come out onto the turf surface. The sod webworms may be over 1 inch long if they are fully grown. All of these creatures will go back into the thatch in a few seconds, so keep an eye on the area for 3 or 4 minutes. If there are at least two or three sod webworms per square foot, their numbers are high enough to cause damage.

You can also scout sod webworms by watching for the adult moths. Large numbers of 1-inch-long tan moths that fly low to the ground in a zigzagging and dipping motion are probably sod webworms. When at rest, these moths hold their wings tight against their bodies in a tubelike fashion. If you have large numbers of moths in turf and the weather stays dry, applying insecticide two to three weeks later will kill the young caterpillars that result. Sod webworms have several generations per year, so you may find these insects at any time during the growing season. Several insecticides provide effective control. *(Phil Nixon and Bruce Spangenberg)*

PLANT DISEASES

Bacterial Wilt of Vine Crops

Wilt diseases occur when a pathogen plugs a plant's water transport system. Bacterial wilt of vine crops is caused by a bacterium, a pathogen so small that thousands can be found in bacterial exudate the size of a drop of water. Even so, the pathogen can multiply quickly and plug the vascular tissues. When this happens, water transport does not occur, and growers report that their plants suddenly wilt and die. This tiny bacterium is transported from plant to plant by the striped and spotted cucumber beetles.

Cucumbers and muskmelons (or cantaloupes) are the major hosts of bacterial wilt, and this is where we see the most damage. The disease can also occur on pumpkins, squash, and rarely watermelon, although it is usually not as severe. Wilt symptoms appear first on individual leaves but quickly spread to lateral shoots; finally, the entire plant wilts. Symptoms develop more quickly on younger, smaller plants.

There is a "quick-and-dirty" field test for this disease. To confirm the presence of bacterial wilt, cut a live, wilted runner off the plant near the crown. You only need the 5 or 6 inches of stem nearest the crown. Cut the stem section in two, hold the cut ends so that they are back together, and squeeze them until the plant sap flows out from each cut edge and the sap intermingles. Then slowly pull the cut ends apart. If there is a strand of sticky sap between the cut ends, a bacterium is probably present and bacterial wilt is a strong possibility. Unfortunately, after you confirm the presence of this disease, there is nothing you can do to stop it in the infected plant. This knowledge should help you control the disease next year.

The primary method for controlling bacterial wilt is to control the beetle vector, the striped and spotted cucumber beetles. The beetles overwinter as adults, and they are present when the vine crops emerge. Because the beetles are most attracted to plants in the cotyledon stage, insecticides should be initiated immediately after planting. Apply insecticides late in the day when blossoming begins so as not to interfere with pollination by bees. Both a preplant systemic and a postemergence protectant insecticide may be necessary to prevent a problem with bacterial wilt in commercial plantings. Commercial growers find that treatment with Furadan at planting time gives moderate control for three to four weeks, but supplemental insecticide use is also necessary. Home growers usually spray plants with an insecticide weekly from the time plants break the soil (or when they are transplanted) until they are in bloom. Chemical options are listed in the homeowner and commercial pest control handbooks. Consult *RPD* No. 905 for details about bacterial wilt. *(Nancy Pataky)*

Aster Yellows

Aster yellows is a disease caused by a phytoplasma, formerly known as a mycoplasma. Phytoplasmas are the pathogens most similar to bacteria. They grow in the phloem tissue of plants and cause distortions in plant growth. The aster yellows phytoplasma is transmitted by sucking insects—in this case, leafhoppers—and cannot be cultured in a laboratory.

You see this disease most commonly on chrysanthemum, aster, daisy, marigold, phlox, and petunia, but it occurs on many other species as well. Affected plants are easy to distinguish because they are yellowish, stunted, stiff, erect, and bushy due to their witches'-brooms. The flowers may be deformed with partially or totally green leafy petals. The plants look as if they have been affected by a virus.

Because the pathogen can be transmitted by leafhoppers, control measures include destroying all affected plants when they are first seen, eliminating broadleaf weeds that can host the pathogen, and, of course, buying symptom-free plants. Spraying regularly to keep leafhoppers from feeding may be beneficial in a commercial setting.

We do not see many aster yellows samples in the lab, partly because these plants are rogued before they reach the retail outlets. Symptoms are easy to identify by comparing plants to disease identification photos. Because the pathogen cannot be cultured in the lab, sending a sample to the Plant Clinic is not necessary. For a detailed description of these diseases, consult *RPD* No. 903. *(Nancy Pataky)*

Tomato Leaf Spots

Septoria leaf spot, early blight, and anthracnose are common tomato diseases in Illinois. You probably recognize these fungal names because related species occur on many other landscape plants. Septoria leaf spot and early blight diseases defoliate the plants, exposing the tomato fruit to sunscald, which contributes to the development of anthracnose on the fruit. Anthracnose is another fungal disease, and all three fungi can be controlled using the same practices.

Septoria leaf spot is a more common disease for Illinois home gardeners. The disease appears initially as small, water-soaked spots on the lower leaves.

These spots soon become circular to angular, with dark margins and grayish white centers that often bear one or more tiny black specks called pycnidia. The individual lesions are about 1/8 inch in diameter, but they are easy to spot because the leaf quickly turns yellow and drops from the plant. Defoliation starts at the base of the plant and can be severe during prolonged periods of warm, wet weather. When a grower complains of tomato plants dying from the bottom upward, we usually look first for Septoria leaf spot.

Early blight appears on tomatoes as they start to set fruit. High humidity levels and persistent dews are favorable for early blight, and cool temperatures may favor disease development. This fungal foliar disease is caused by *Alternaria*. It is characterized by small brown leaf spots with a targetlike series of concentric rings within each lesion. As with Septoria leaf spot, lower leaves show symptoms first.

Early blight can cause economic loss, but sprays are not usually initiated until spotting occurs. Generally, sprays are started at first bloom; however, some of the newer tomato varieties may be more susceptible to this fungal blight, and sprays may be needed earlier on those varieties. Scout for this disease regularly, especially in wet weather. Dry weather is not favorable for development of early blight, but we still see it in drought periods when growers use frequent overhead irrigation.

Anthracnose ripe rot causes lesions about 1/2 inch in diameter on the ripened fruit of the tomato. Concentric rings may appear within these lesions. Although fruit lesions are the most common symptom, this disease may appear on other plant parts as well.

Commercial growers must often rely on chemical control of these diseases. Chemical control can be obtained with Bravo, mancozeb, or Quadris, applied at seven- to ten-day intervals, after the first sign of disease, or after the first fruit forms. In areas with high rainfall, growers should stay with the shortened intervals. Home growers should concentrate on keeping all ripe fruit picked off the plants, improving air circulation in the garden, mulching to avoid fruit rots, and removing tomato vines and unharvestable fruit at the end of the season. A two- or three-year crop rotation is also suggested to reduce losses from these diseases. A soil-surface spray of mancozeb after the last cultivation improves anthracnose control in commercial plantings. Chemical options for home growers are listed in the *Illinois Homeowner's Guide to Pest Management*. Varieties such as Floramerica, Jetstar, Manlucie, Roma VF, and Supersonic have some tolerance to early blight. For more information, consult *RPD* No. 908. *(Nancy Pataky)*

Home, Yard & Garden Pest Newsletter *is prepared by Extension specialists from the University of Illinois at Urbana-Champaign and the Illinois Natural History Survey. Information for this newsletter is gathered with the help of staff members, Extension field staff, and others. Karel Jacobs and Donna Danielson of The Morton Arboretum also provide information and articles.*

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